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Geologische Charakterbilder

Begründet von H. Stille

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23. Heft

Geysers of Yellowstone National Park

by

N. H. DARTON, WASHINGTON

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Geologische Charakterbilder

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Die „Geologischen Charakterbilder“ bringen Lichtdruckreproduktionen nach sorgfältigst ausgewählten photographischen Aufnahmen von geologisch und geographisch wichtigen und charakteristischen Bildungen, welche den Bau, die Entwicklung und die Oberflächengestaltung der Erdrinde zu veranschaulichen geeignet sind. Insbesondere werden Art und Wirkungen der endogenen und exogenen Kräfte, typische Entwicklungen der Gesteine und Formationen, die Struktur der Gebirge, sowie vor allem auch die Klein- und Großformen der Erdoberfläche in ihrem Zusammenhang mit der Entwicklung und dem Bau des Untergrundes zur Darstellung gelangen. Durchschnittlich sechs, gelegentlich mehr, gelegentlich weniger Bilder, die räumlich oder der Materie nach zusammengehörige Dinge darstellen, werden dabei zu je einem Hefte zusammengefaßt. Jedes Heft bildet eine selbständige Veröffentlichung des Autors und ist als solche auch einzeln käuflich.

Die „Geologischen Charakterbilder“ sollen in erster Linie einem im geologischen und geographischen Unterrichte an Universitäten und anderen Hochschulen, sowie auch an höheren Schulen tief empfundenen Bedürfnisse nach bildlichem Demonstrationsmateriale abhelfen. Aber auch außerhalb von Hörsaal und Schule werden sie, da erst das Bild, erläutert durch das geschriebene Wort, eine lebendige Vorstellung der Dinge zu geben vermag, als wichtiges Hilfsmittel für wissenschaftliche Arbeit und literarische Tätigkeit auf geologischem und geographischem Gebiete willkommen sein. Schließlich können sie auch manchen Museen zur bildlichen Ausgestaltung ihrer naturwissenschaftlichen Sammlungen dienen, indem sie die Vorkommen einzelner ausgestellter Objekte in der Natur erläutern und erst dadurch dem Beschauer der Sammlungen die Bedingungen nahebringen, unter denen das Material gebildet oder gefunden wurde, was zur Abrundung seines Wissens unerläßlich erscheint — eine Ergänzung insbesondere der geologischen Sammlungen, welche aus dem toten Nebeneinander der Objekte einen lebensvollen Lehrstoff zu gestalten geeignet ist.

Für die Tafeln ist das Format 24:30 cm gewählt worden, da einerseits bei diesem eine scharfe Wiedergabe der im allgemeinen im Formate 9:12 cm aufgenommenen Originalbilder noch gewährleistet ist, während es anderseits als recht handlich für den praktischen Gebrauch in der Vorlesung usw. erscheint.

Jedem Bilde ist ein erläuternder Text beigegeben, so daß Wort und Bild sich zur Veranschaulichung der behandelten Materie ergänzen. Der erläuternde Text enthält, falls es wünschenswert erscheint, Skizzen und Profile, und die Bilder tragen erforderlichen Falles durchsichtige Deckblätter mit erläuternden Eintragungen.

Beschriftung des Bildes und Erläuterung werden in deutscher, englischer oder französischer Sprache abgefaßt sein.

Der an eine Reihe der namhaftesten Geologen und Geographen gerichteten Bitte des Herausgebers um weitere Mitarbeit an dem Werke ist fast in allen Fällen eine freudige Zusage gefolgt, und so steht zu hoffen, daß die Sammlung bald ein mehr und mehr die ganze Erde umspannendes geologisch-geographisches Abbildungsmaterial umfassen wird. Geologen und Geographen, die geeignete Vorlagen besitzen und für weitere Kreise nutzbar machen möchten, sind zur Mitarbeit willkommen.

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Geysers of Yellowstone National Park

By N. H. Darton, U. S. Geological Survey, Washington, D. C.

The Yellowstone National Park is a Government reservation comprising about 3,400 square miles in the northwestern corner of the State of Wyoming. It contains several groups of active geysers and hot springs of great beauty and variety, which are a source of interest to a very large number of visitors from all parts of the world. The geysers present considerable diversity of form, size, activity, and products. Many of them throw great columns of water high into the air at frequent intervals, while others erupt rarely. The region is one in which there has been extensive and long-continued volcanic action. Although this lasted until relatively recent times, geologically, there have been no igneous eruptions in a good many thousand years. It is believed that the heat causing the geyser action is from the volcanic rocks which are still hot at no great distance below the surface. The waters appear to be of surface origin and in sinking underground they become heated by steam rising through fissures from the heated rocks below. When the temperature rises sufficiently above the boiling point to lift a column of water it is forced out through a fissure as a geyser eruption. That there is much movement of steam and water through the more recent igneous masses is shown in many of the gorges, notably in the great canyon below the Yellowstone Falls, where the rocks have been profoundly decomposed by this agency. The long-continued action of steam and boiling water passing through the interstices and crevices in the rhyolites has altered them to spongy masses of kaolin partly stained to brilliant colors, and left but little of the original rock. In many places this result indicates the former existence of geysers, hot springs, and other hot-water phenomena and many mounds of the characteristic sinter deposits also occur. At present there is considerable geyser action in many parts of the Yellowstone Park, but apparently it is much less in amount than in the past. The Mammoth Hot Springs in the northern part of the park is one of the most notable features of its kind in the world, and the groups of geysers and related phenomena in Norris Basin, Lower Geyser Basin, and Upper Geyser Basin are of greatest interest and impressiveness. It has been estimated that there are more than 4,000 hot springs in the park not counting many steaming fissures, and about 100 geysers. It is difficult to make distinction between a hot spring and a geyser, for many of the springs boil for long periods and erupt occasionally or even only once.

The deposits of which the beautiful geyser cones and terraces consist are mainly silica, for the slightly alkaline waters in the present geyser areas come from rhyolites. These deposits are built up by thin layers often intricately fluted or of a lacework pattern and mostly of pure white color. The region is about 8,000 feet above sea level and the groups of geysers are mainly in valleys traversed by streams, many of them on the bank of a stream as shown in Tafel 1.

In the map, figure 1, is shown the location of the numerous geysers in the upper basin, including the Excelsior, Castle, and Old Faithful of Tafel 2, 3, and 5, and the Grand Group shown in Tafel 1.

It has been suggested that radioactivity might cause some of the hydrothermal action in the Yellowstone Park, but special investigations have shown that the emanations were too weak to be a material factor.

The geysers of the Yellowstone Park are visited by many thousands of tourists every summer. Short branches from two transcontinental railroads give easy access and stage lines, hotels, and camps afford every facility for the sightseer.

Literature.

The following are a few of the more useful publications relating to the Yellowstone Park and its geysers.

HOLMES, W. H., On the geology of the Yellowstone National Park. U. S. Geol. and Geogr. Survey of Territories, F. V. Hayden, 12th Rept. (1878), part 2, pp. 1—57, Washington, 1883.

HAGUE, ARNOLD, et al. Geology of the Yellowstone National Park, Part II, Descriptive geology, petrography, and paleontology. U. S. Geol. Survey Monograph 32, XVII, 893 pages, 121 plates and atlas of 27 sheets folio. Washington, 1899. (Part I, General geology, in preparation.)

—, Geological history of the Yellowstone Park. Department of the Interior, 23 pages, Washington, 1912.

WEED, WALTER, Geysers. Department of the Interior, 29 pages, Washington, 1912.

HAGUE, ARNOLD, The Yellowstone Park, 5me Congrès Géologique Internationale, Compte Rendu. Guide to geological excursions to the Rocky Mountains, 1891.

—, Origin of the thermal waters in the Yellowstone National Park. Address to Geological Society of Washington: Science, n. s., vol. 33, 1911, pp. 553—558.

MARTONNE, Emm. de, Le Parc National du Yellowstone, Etude Morphologique. Annals de Geogr., Vol. 22, 1913, pp. 134—148, figs 1—5, plates.

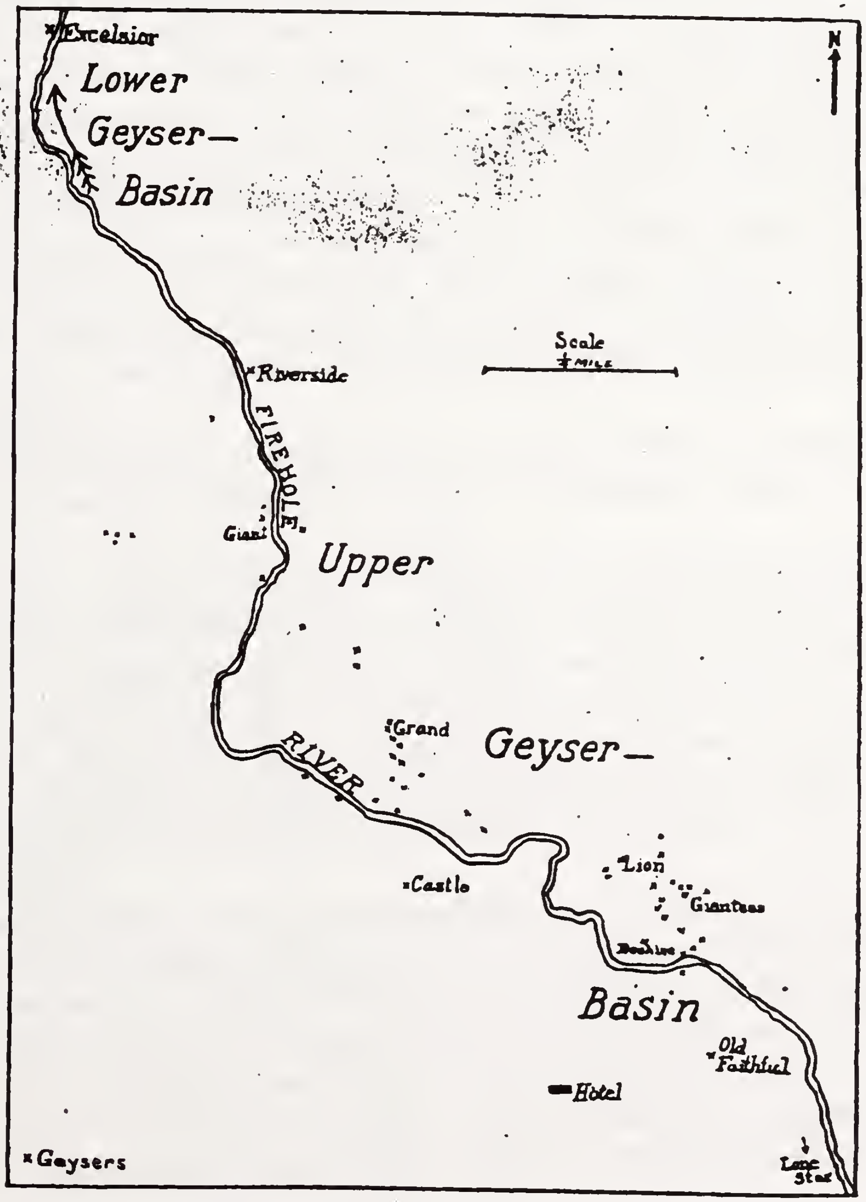


Fig. 1

Geysers of Yellowstone National Park

By N. H. Darton, U. S. Geological Survey.

Tafel 1.

„Hells half acre“, the grand group of geysers on the east bank of Firehole River, in the Upper Basin, Yellowstone National Park.

In this view are shown the columns of steam rising from 20 active geyser vents in a great mound of siliceous sinter on the east bank of the Firehole River in the Upper Basin. In the center is the Giantess which is one of the most notable in the park. It erupts every week or two weeks, and throws a large column of boiling water to a height of over 100 feet. This continues for several hours and a large volume of water is ejected. The crater of this geyser is bowl-shaped and about 25 feet in diameter and 60 feet deep. When quiescent it is filled with pale greenish water bubbling slightly. At the beginning of an eruption much of this water rapidly wells out over the edge and then the spouting begins in great jets, many of which are thrown 100 feet into the air. After the eruption there is a long period of steaming which produces a roaring sound that is audible for several miles. When the eruption begins there are strong pulsations in the adjoining geysers, which appears to indicate underground connection.

About 310 yards west of the Giantess is the Bee Hive Geyser, so named from the shape of its circular cone which is about 6 feet high, 7 feet in diameter at base and tapering up to 3 feet at top.

Its nozzle-like opening is about 18 inches wide at the top, but tapers downward to a small hole. The period of this geyser varies, but there are about three eruptions every day; at times, however, the interval is much longer. Usually there are several eruptions three hours apart, following an eruption of the Giantess. The small column which it throws in a steady stream and attains great height; a relatively large body of water is ejected in the 10 or 15 minutes of its eruption. A small geyser a few feet from its base generally indicates an approaching eruption of the Bee Hive, by throwing up jets of water and steam, about 15 minutes in advance.

Other notable geysers in the group shown in the view are the Lion and Lioness, and the Cubs. The first is an irregular, flat-topped cone 4 feet high. Its eruption interval varies from 3 to 20 hours, and the eruption lasts about 10 to 15 minutes. It throws a large column of water to a height of 60 feet. The Lioness erupts about once a day and the Cubs every two or three hours. The Cascade geyser, shown in the extreme right of the view, erupts at very short intervals. The column of water is thrown about 30 feet high with voluminous steam emission and the overflow water rushes in a large stream over the bank of sinter into the river.

Geysers of Yellowstone National Park

By N. H. Darton, U. S. Geological Survey.

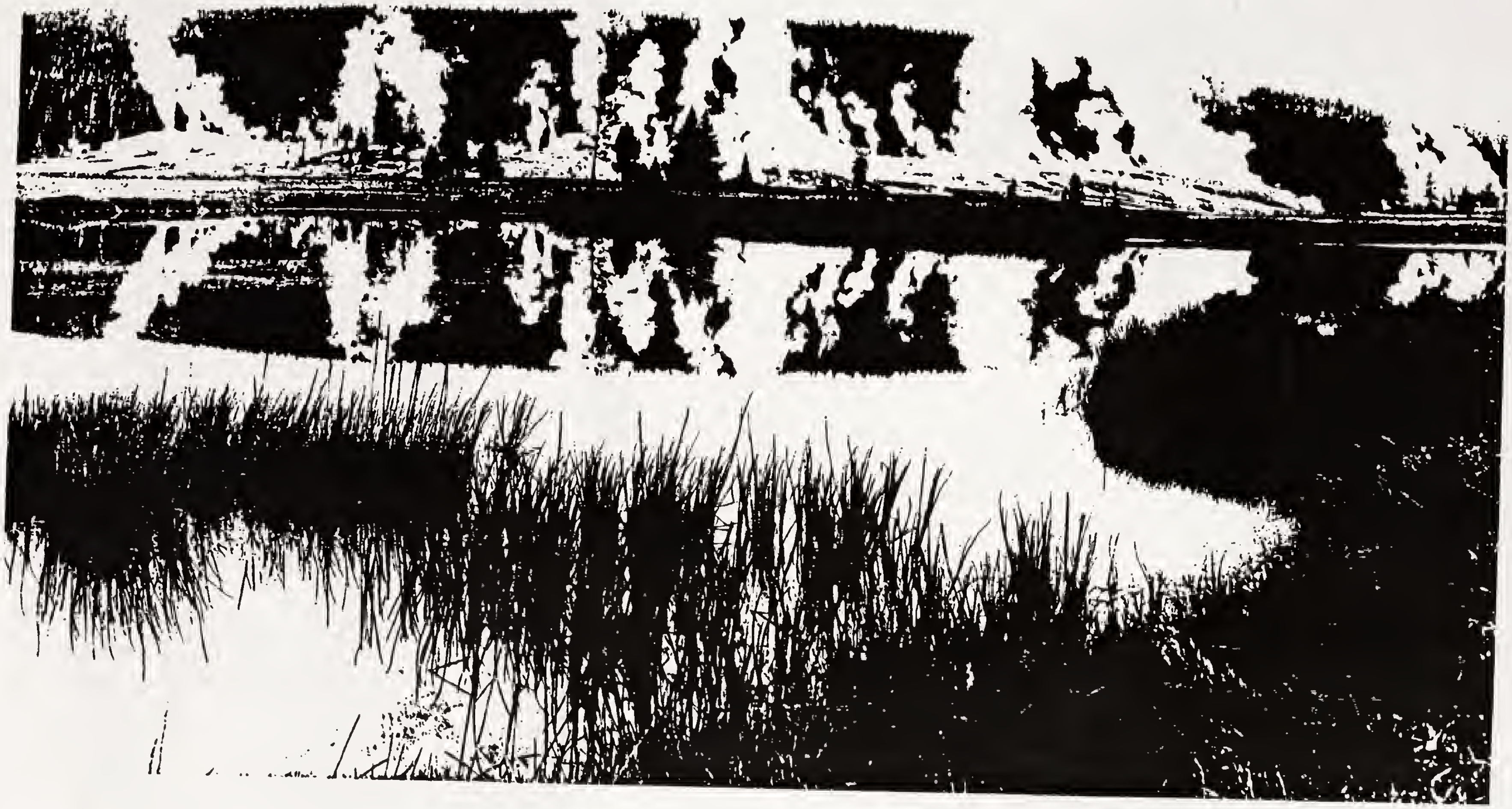
Tafel 2.

Castle Geyser, Upper Geyser Basin, Yellowstone National Park.

The Castle Geyser is one of the large group of geysers of the Upper Basin and is on the west side of Firehole River not far from Old Faithful geyser. Its crater, which is one of the largest in the region, rises about 10 feet above the surface of a low, rounded mound of siliceous sinter about 100 feet in diameter. The crater and mound are of nearly pure white silica, deposited layer by layer by the hot water of the eruptions. The crater is of irregular outline for as it has increased in size portions have been broken off from time to time. Its diameter is about 20 feet, and its round orifice three feet across is lined with algae of bright orange color.

The Castle Geyser has an eruption interval of 8 to 30 hours. The premonitory features are intermittent spurtings of hot water to a height of 15 to 20 feet which last for several hours. Finally this gives place to the main eruption in which columns of water are shot to a height of 50 to 75 feet for about a half-hour. Thence follows a long period of steaming.

Every few weeks there are eruptions of exceptional volume when the water is thrown to twice the usual height and there is persistent and vigorous steaming afterward. A strong boiling spring reaches the surface near the base of the Castle Geyser cone. There is also a large conical hot pool just north of the geyser known as Castle Well. It is 20 feet in diameter and generally overflowing. The slopes and overflow are covered by bright colored algae. In the view this pool can be located to the left of the crater by the steam rising from it.



„Hells Half Acre“, a group of active geysers on Firehole River, Yellowstone National Park. U. S. A.

„Hells Half Acre“, eine Gruppe aktiver Geysire am Firehole-Fluß. Yellowstone-Nationalpark. Vereinigte Staaten von Nordamerika.

„Hells Half Acre“, un groupe de Geysers en action, au bord de la rivière Firehole. Parc National du Yellowstone aux États-Unis.

Photo by J. Hillers. U. S. Geol. Survey

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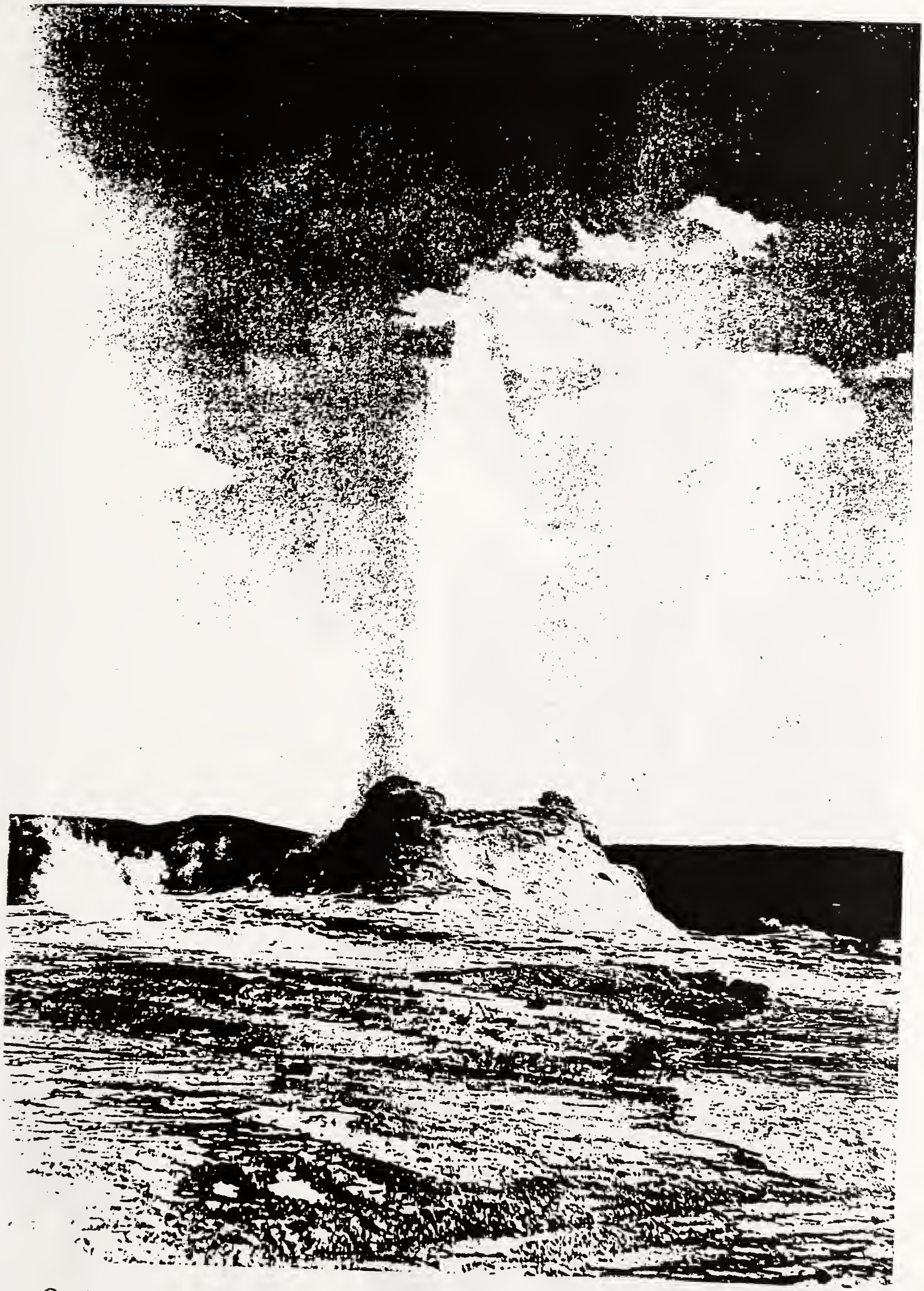

Castle Geyser in eruption. Upper Geyser-Basin. Yellowstone National Park. U. S. A.

Schloß-Geysir in Eruption. Oberes Geysir-Becken. Yellowstone-Nationalpark. Vereinigte Staaten von Nordamerika.

„Castle“-Geyser en éruption. Bassin supérieur du Yellowstone aux États-Unis.

Photo by J. Hillers. U. S. Geol. Survey

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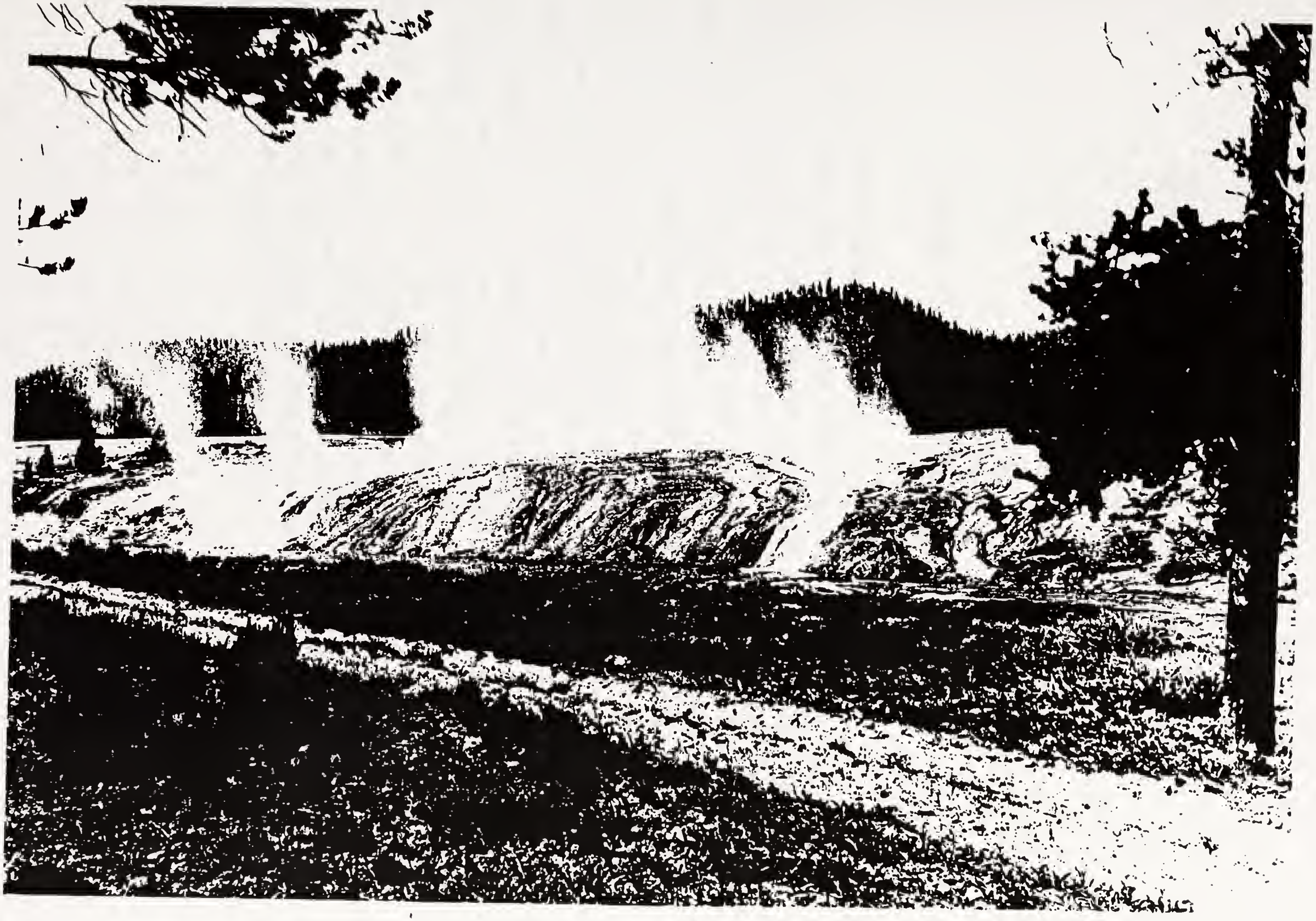


Excelsior Geyser. Yellowstone National Park. U. S. A.

Excelsior-Geysir. Yellowstone-Nationalpark. Vereinigte Staaten von Nordamerika.

Excelsior-Geyser. Parc National du Yellowstone aux États-Unis.

Photo by J. Hillers. U. S Geol. Survey

Geysers of Yellowstone National Park

By N. H. Darton, U. S. Geological Survey.

Tafel 3.

Excelsior Geyser, Yellowstone National Park.

The Excelsior geyser is situated on the west bank of Firehole River, a few miles south of the Fountain geyser. It is an isolated center of thermal activity but during the many years of its existence it has built up a great mass of siliceous sinter. This consists mostly of a flat-topped terrace about 30 feet high containing the large crater-form orifice of the Excelsior geyser and a number of pools. Ordinarily the geyser is a pool of deep-blue steaming water, in a irregular pit 330 feet long by 200 feet wide, with its surface about 15 feet below the general terrace level. From one side there is a moderately strong overflow over a low break into the river, as shown in the view. There have been no recent eruptions, but in 1881 and 1888 some mighty outbursts were witnessed. The water in enormous volume was thrown several hundred feet into the air and vast clouds of steam were ejected. The eruptions lasted a short time, but were repeated every few hours for several months. Formerly was the largest and most vigorous geyser in the park. The slope traversed by the overflow from this geyser contains algae of brilliant colors which give a very striking appearance to the portions of the terrace slope down which the hot water flows. The water is depositing silica and it is of this sinter that the terrace is built. The layers are thin and a long time has been required for the accumulation of the great mass at this place.

Excepting when covered by algae the color of the sinter is pure white. It is claimed that in former times the water flowed in greater volume and probably then some of the hot pools on the terrace were geysers. The water has flowed in various directions, for the deposits exhibit considerable complexity of structure and form.

Geysers of Yellowstone National Park

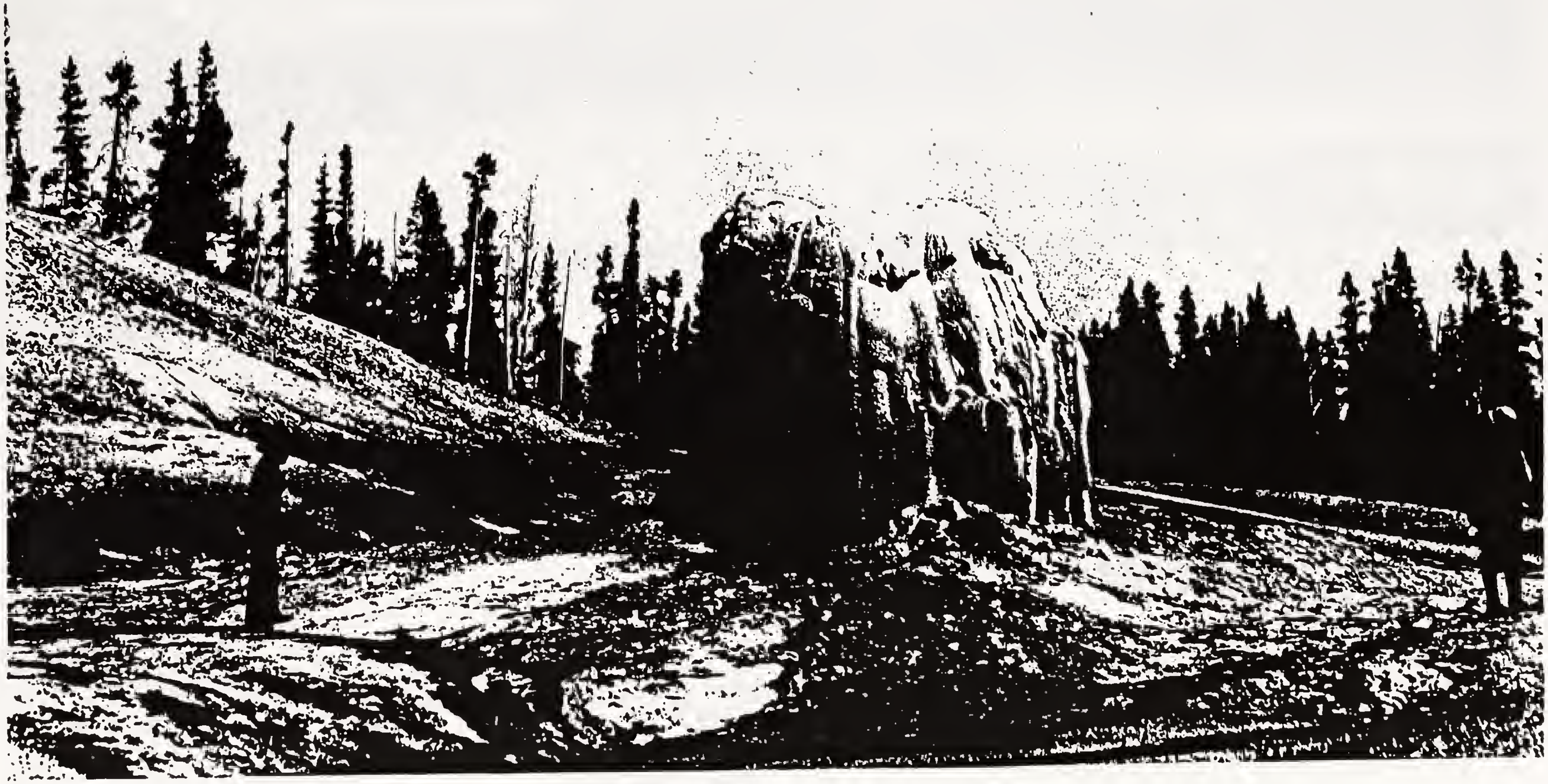
By N. H. Darton, U. S. Geological Survey.

Tafel 4.

Lone Star Geyser, Yellowstone National Park.

This fine geyser is in an isolated thermal area 2 3/4 miles southeast of the Old Faithful Geyser in the Upper Basin. Its cone is about 10 feet high, and 12 feet in diameter at the base. The top is about 6 feet across and near its center is one large opening with several small orifices, from all of which water is thrown during an eruption. The Lone Star plays at intervals of 30 minutes and at times its thin jets of boiling water are thrown to a height of 50 feet. Considerable steam is ejected at the same time. Between eruptions the water level sinks some distance below the outlet, but immediately preceeding an outburst it rises rapidly to the top and overflows slightly. The cone of this geyser is brightly colored with algae, the principal colors being brown and yellow in bands on a white and lavender background. The surface is covered with beadlike forms of the silica of rather novel character. The sinter mound from which the geyser cone rises is about 60 feet in diameter rising slightly above the shallow valley in which it is situated.

N. H. Darton, Geysire des Yellowstone-Nationalparkes.



Lone star Geyser in eruption. Yellowstone National Park. U. S. A.

„Lone star"-Geysir in Eruption. Yellowstone-Nationalpark. Vereinigte Staaten von Nordamerika.

„Lone star"-Geyser en éruption. Parc National du Yellowstone aux États-Unis.

Photo by Jackson. U. S. Geol. Survey

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Old Faithful Geyser in eruption. Yellowstone National Park. U. S. A.

„Der alte Getreue“ in Eruption. Yellowstone-Nationalpark. Vereinigte Staaten von Nordamerika.

„Old Faithful“-Geyser en éruption. Parc National du Yellowstone aux États-Unis.

Photo by Jackson. U. S. Geol. Survey

Geysers of Yellowstone National Park

By N. H. Darton, U. S. Geological Survey.

Tafel 5.

Old Faithful Geyser, Upper Geyser Basin, Yellowstone National Park.

This view was taken at a distance to show some of the features surrounding the remarkable geyser. „Old Faithful" is well-named, for its eruptions are at remarkably regular intervals of about 65 minutes throughout the year. The crater is in a low mound of siliceous sinter, about 150 feet in diameter. At the top of the mound there is a built-up portion about 20 feet wide by 50 feet long and 3 to 6 feet high containing the crater which is an oblong opening about 6 feet long and 2 feet wide, of light yellowish brown color. The eruption begins with a welling up of the water with slight overflow, then there are a few spasmodic spurts in which considerable water is ejected lasting about 5 minutes. This is followed by the sudden rise of the great column of hot water to a height of 125 feet where it is sustained with great force, from three to five minutes. The war of escaping steam is so loud that it can be heard for several miles. The water flows off into the river near by, but some remains in pools on the terrace-like steps on the mound. These pools are lined with very intricate forms of the sinter and they show many delicate tints of various colors. At the north end of the crater are large globular masses of sinter of bead-like or pearl-shaped forms.

In the foreground of the view is one of the hot pools with deep funnel-shaped cavity in its center. The water and the algae lining are of beautiful tints.

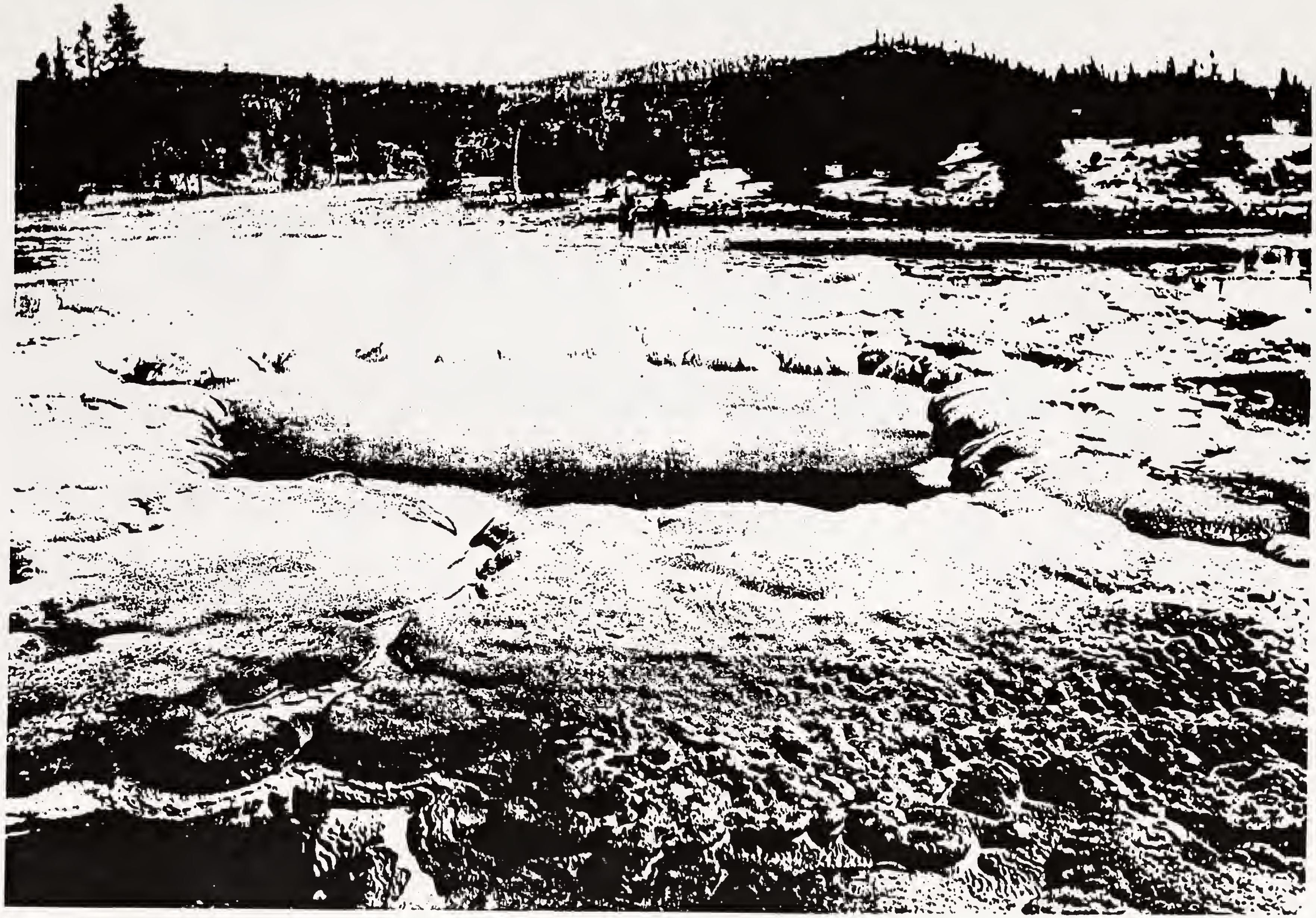
Geysers of Yellowstone National Park

By N. H. Darton, U. S. Geological Survey.

Tafel 6.

Orifice of Fountain Geyser.

The Fountain Geyser is situated in the Lower Geyser Basin near the famous Great Fountain and the Mammoth Paint Pots. The geyser erupts 3 or 4 times a day, somewhat irregularly as to hour, and the water instead of issuing from a cone comes from the funnel-shaped orifice shown in the view. The eruption lasts from 15 to 30 minutes and the column of boiling water is thrown from 20 to 75 feet into the air while a cloud of steam ascends far above. The water falls on the one side or the other, depending on the direction of wind, and flows into a branch of Firehole River. The area surrounding the orifice is thickly covered with a wide, thick accumulation of sinter or nearly pure silica in white amorphous form, presenting rounded and biscuit-shaped aggregations banded and fluted irregularly. It has been dissolved from the decomposing rhyolite, through which the hot water passes. This water is feebly alkaline, a factor which increases its solvent action on the silica.



Orifice of Fountain Geyser. Yellowstone National Park. U. S. A.

Sinterbecken des „Fountain“-Geyser Yellowstone-Nationalpark. Vereinigte Staaten von Nordamerika.

Orifice du „Fountain“-Geyser. Parc National du Yellowstone aux États-Unis.

Photo by C. D. Walcott. U. S Geol. Survey

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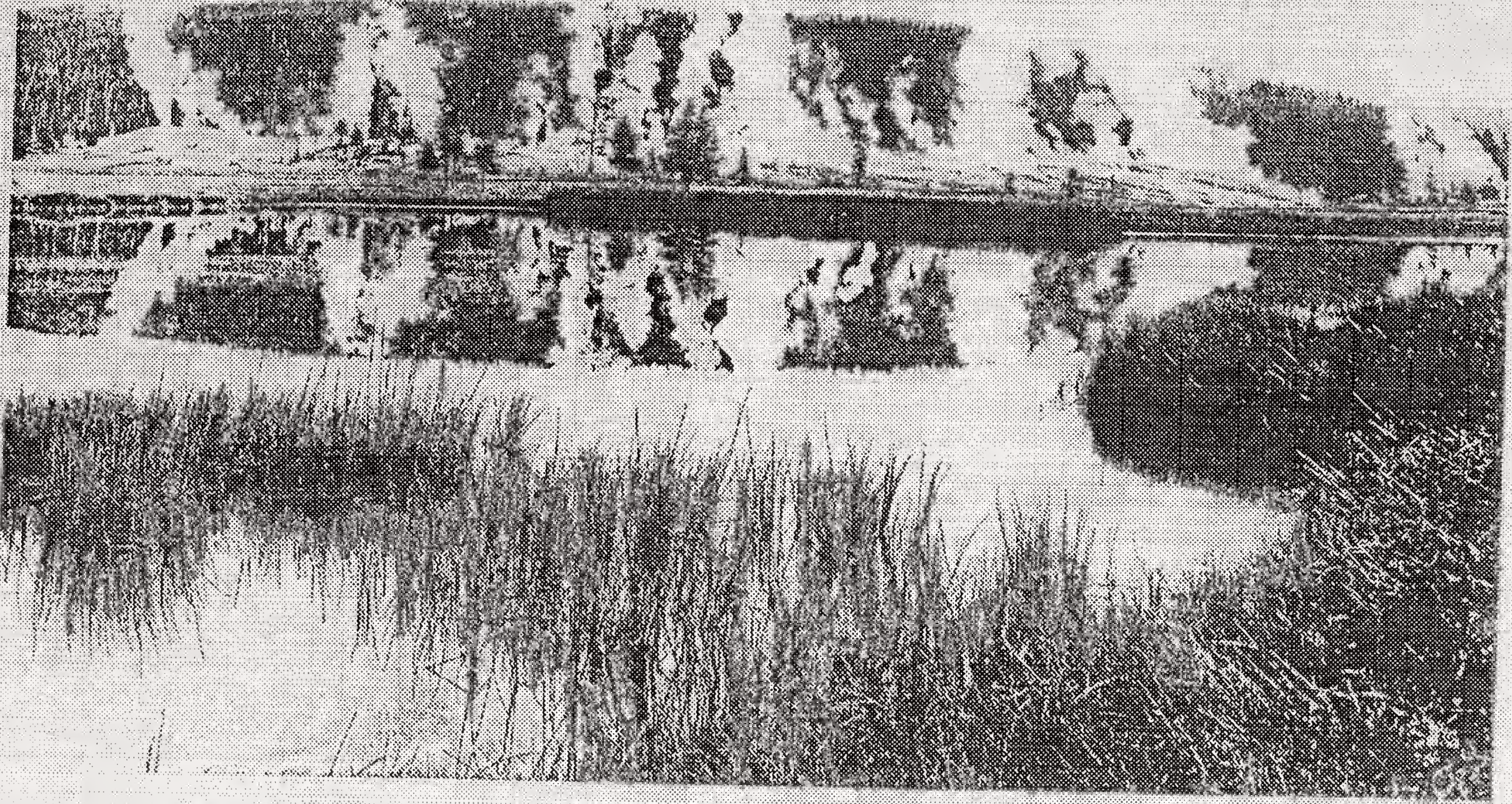

„Hells Half Acre“, a group of active geysers on Firehole River, Yellowstone National Park. U. S. A.

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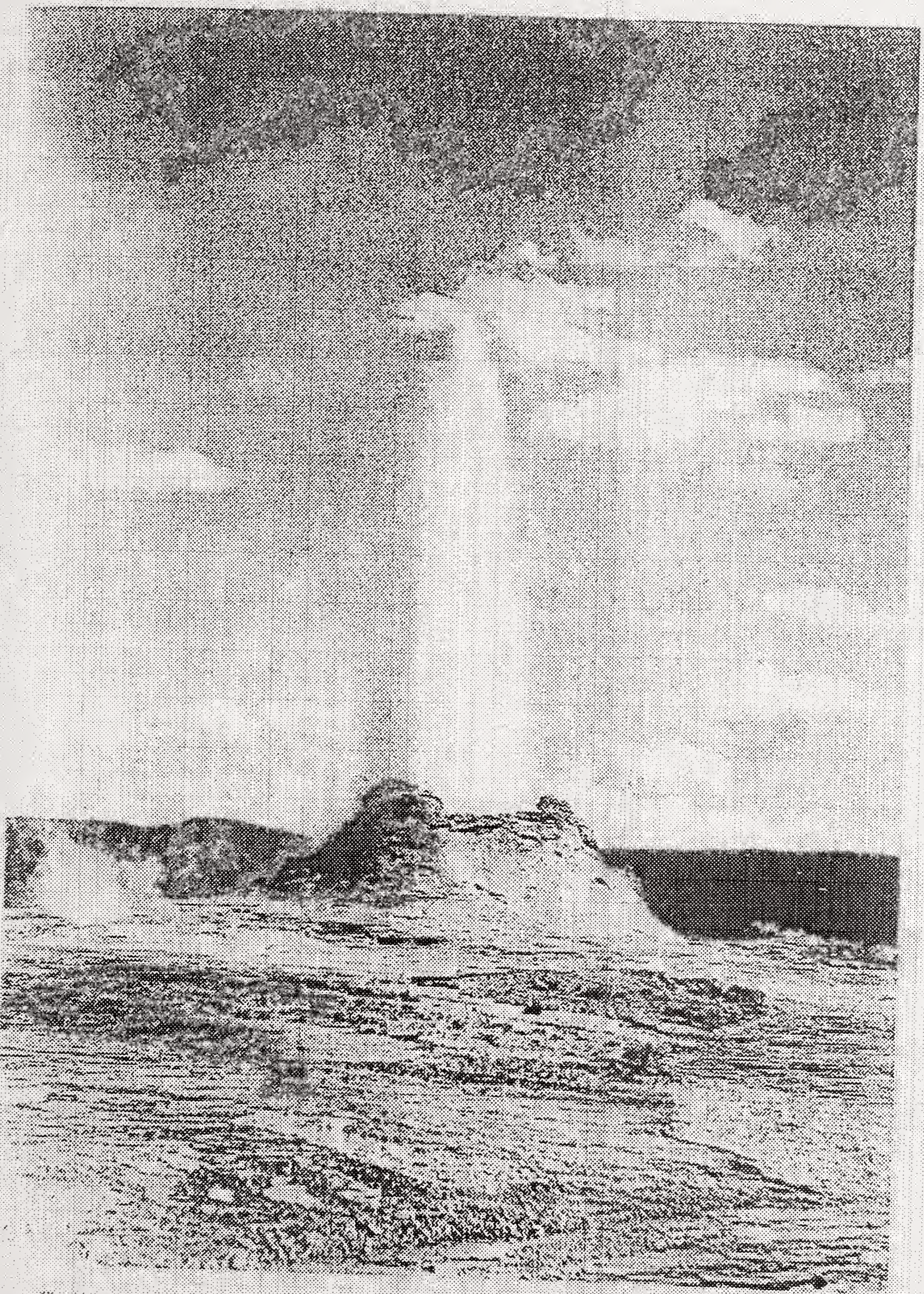

Castle Geyser in eruption. Upper Geyser-Basin. Yellowstone National Park. U. S. A.

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«Castle»-Geyser en éruption. Bassin supérieur du Yellowstone aux États-Unis.

Photo by J. Hillers. U. S. Geol. Survey

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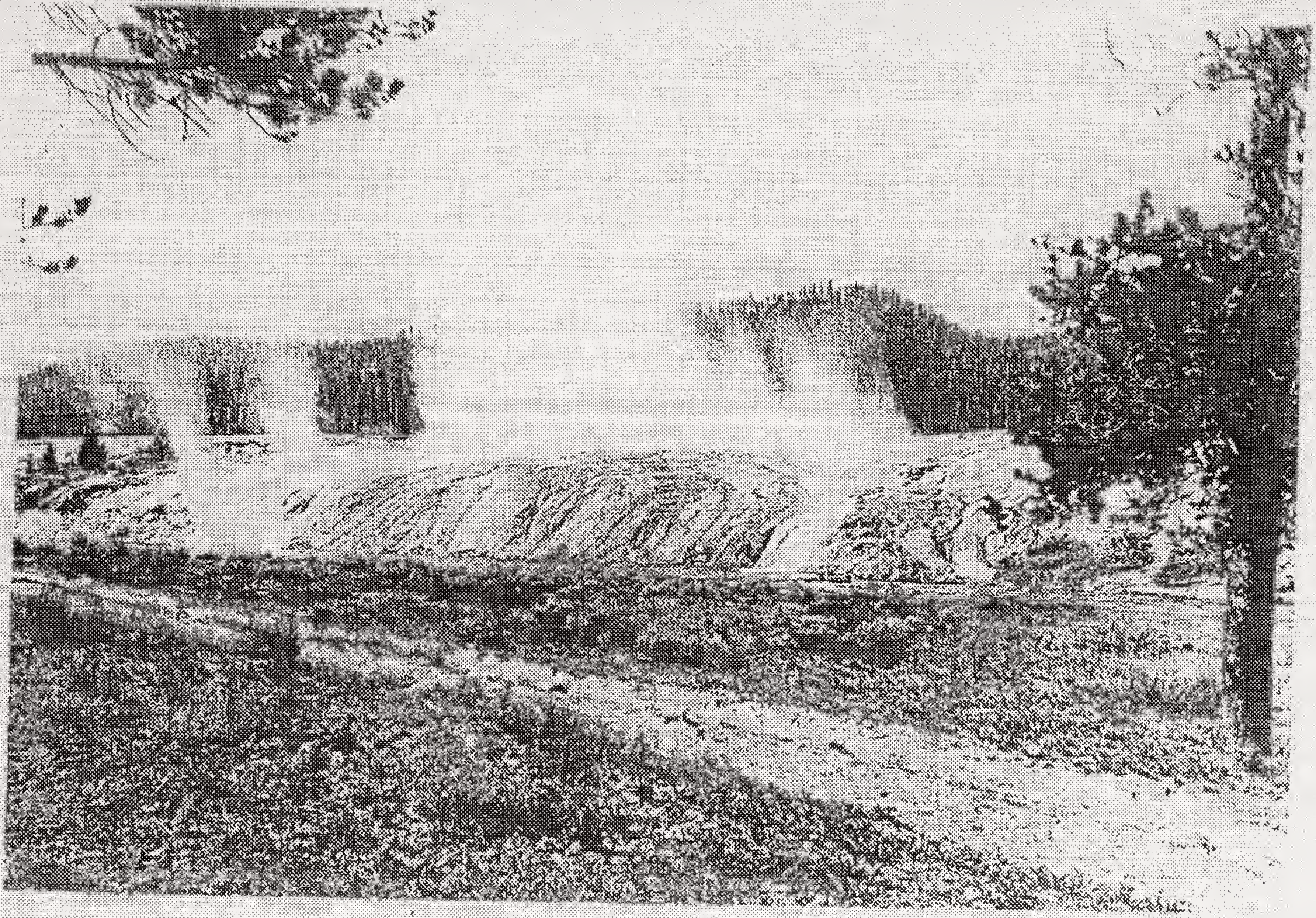
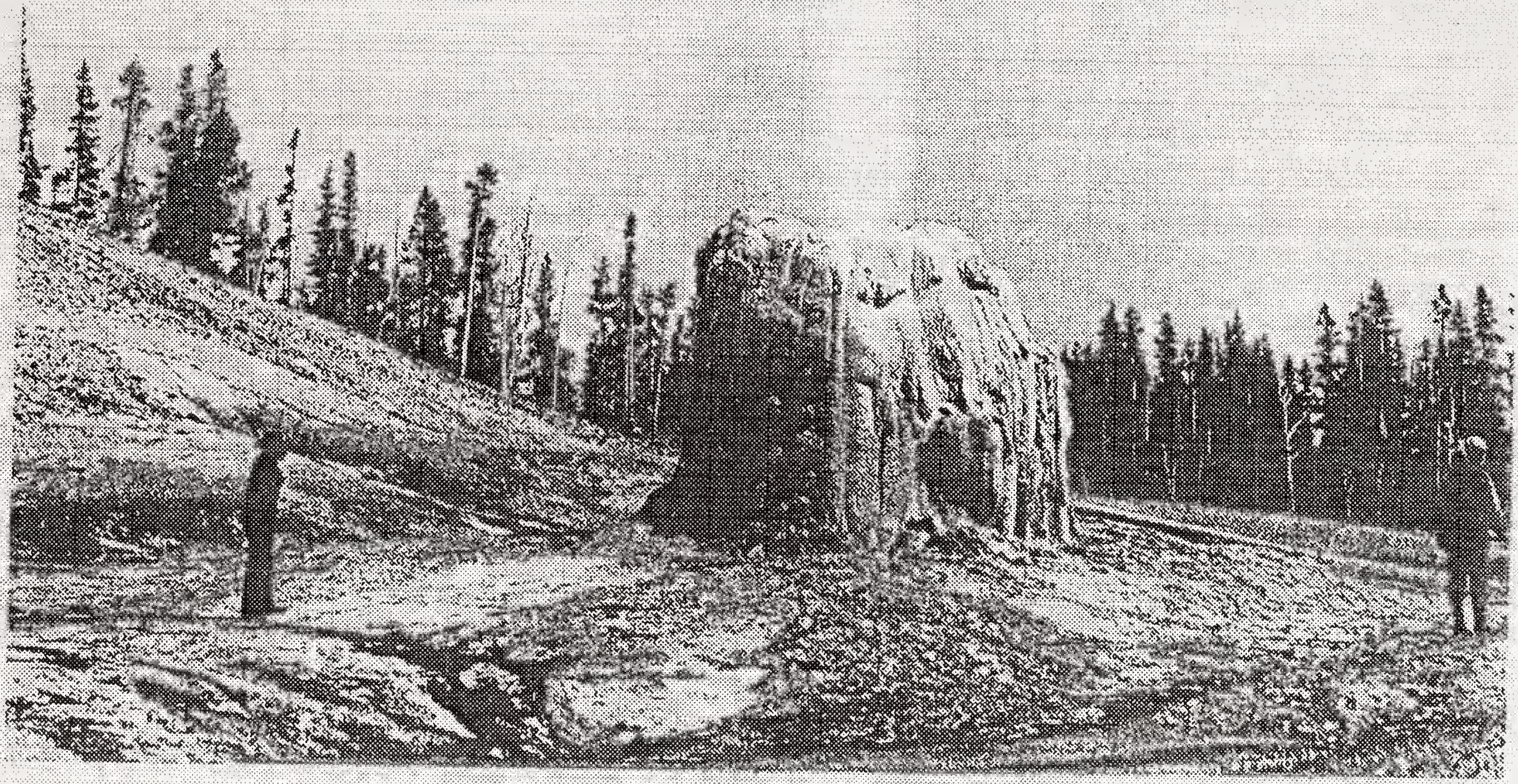


Excelsior Geyser. Yellowstone National Park. U. S. A.

Excelsior-Geysir, Yellowstone-Nationalpark, Vereinigte Staaten von Nordamerika.

Excelsior-Geyser. Parc National du Yellowstone aux États-Unis.

Photo by J. Hillers U. S. Geol. Survey



Lone star Geyser in eruption. Yellowstone National Park U. S. A.

»Lone star«-Geysir in Eruption. Yellowstone-Nationalpark, Vereinigte Staaten von Nordamerika.

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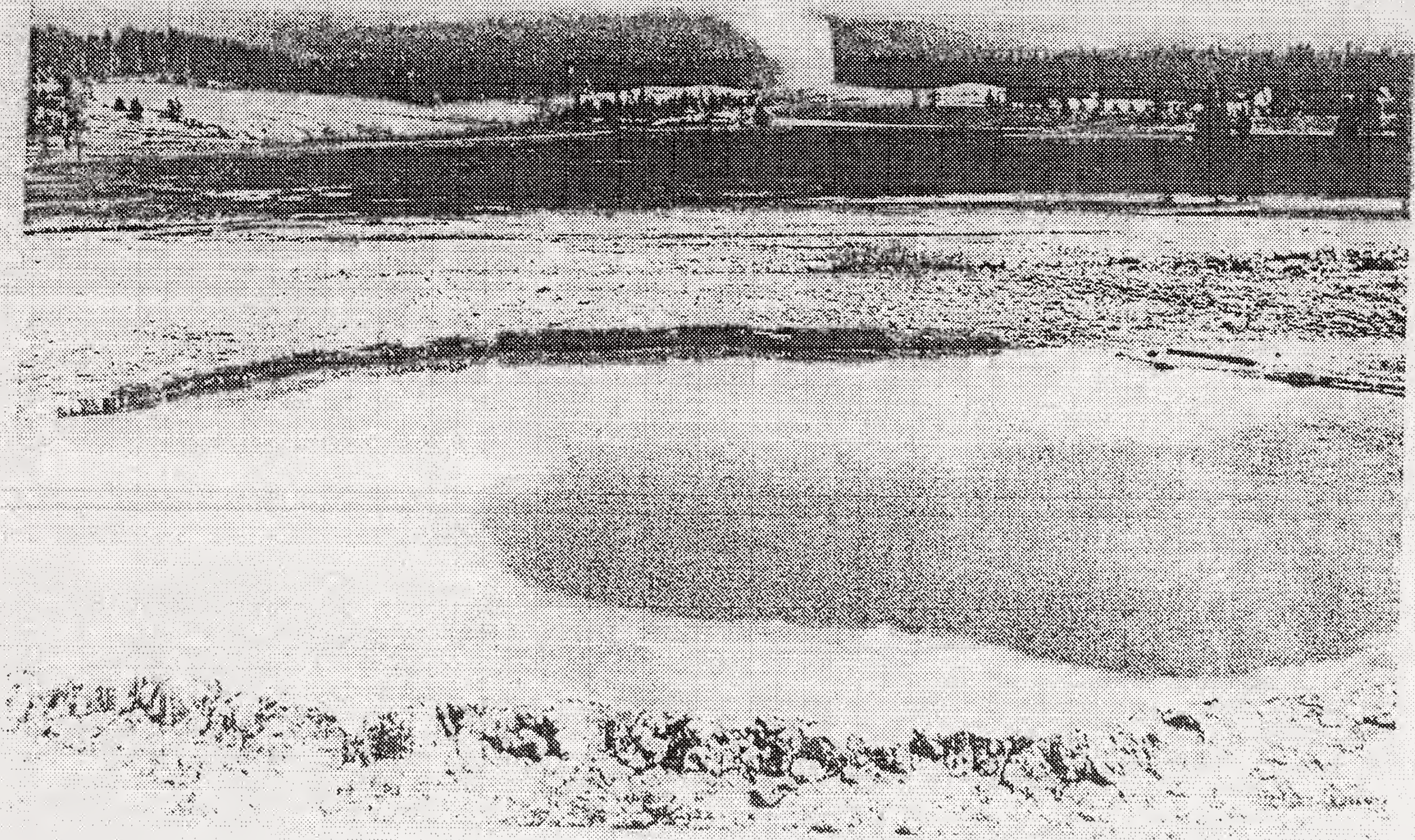

Old Faithful Geyser in eruption. Yellowstone National Park. U. S. A.

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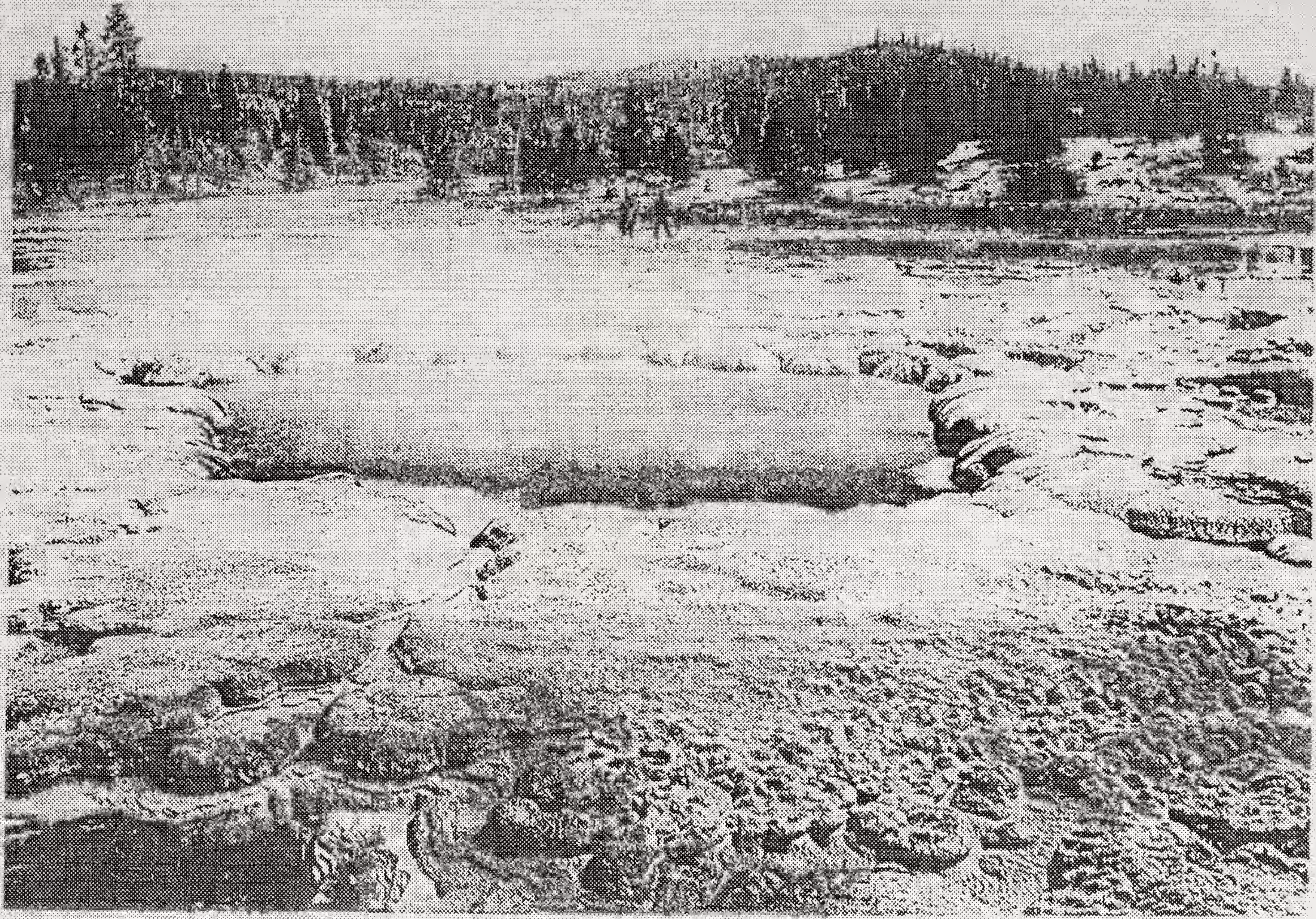

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